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EXAMINER
VINH, LAN

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 06/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/753,065	Applicant(s) JANG ET AL.	
	Examiner Lan Vinh	Art Unit 1765	

-- Th MAILING DATE of this communication appears on the cov r sheet with the correspond nc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 May 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. The request filed on 5/8/2003 for a Request For Continued Examination (RCE) under 37 CFR 1.114 based on parent Application No. 09/753065 is acceptable and a RCE has been established. An action on the RCE follows.

Claim Objections

2. In line 4 of claim 8, the term "HG" appears to be a typographical error. The examiner suggests replacing "HG" with --HF--.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grant et al (US 5,439,553) in view of Cole et al (US 6,238,580)

Grant discloses a method for controlled etching oxide layer/silicon oxide layer via gas phase reactions. This method comprises the steps of:

etching/removing oxide/silicon oxide in HF and methanol maintained in gas phase in a cluster tool apparatus, etching was achieved at a preset temperature and pressure such that all species are substantially maintained in gas phase (see abstract ; col 7,

lines 1-13), which reads on removing the silicon oxide by performing a vapor etching using anhydrous HF and alcohol by controlling a temperature and a pressure inside of an etching chamber to be within the region of a vapor phase equilibrium diagram of water. Grant also discloses that all species present during HF/methanol etching should be in the vapor phase at 95^0 C and higher (col 4, lines 62-67) and the preset temperature of the substrate is from 20-95^0 C, etching is performed at a pressure such that all species present are substantially maintained in the gas phase and condensation of species present on the etched surface is controlled (col 4, lines 57-67; col 9, lines 11-12), which reads on the temperature of the etching chamber is maintained to be higher that that of the substrate so as to discharge the gas without condensing the water and to control physical absorption amount of reactant molecule absorbed on the sacrificial layer.

Unlike the instant claimed invention as per claim 8, Grant does not specifically disclose removing silicon oxide of a sacrificial layer for a microstructure in a MEMS (micro electron mechanical system) device.

However, Cole discloses a method of vapor etching to release a microelectromechanical system (MEMS) comprises the step of removing silicon oxide of a sacrificial layer using vapor HF (col 2, lines 66-67)

Since both Grant and Cole are concerned with method of removing silicon oxide using HF, one skilled in the art would have found it obvious to employ Grant's teaching of removing the oxide with a vapor etching employing anhydrous HF and vapor alcohol in Cole's step of removing a sacrificial silicon oxide layer in a MEMS device since Cole

teaches that the removal of the sacrificial /oxide layer with vapor phase etching is desirable in that it replaces the whole sequence of etching, rinsing step and elaborate drying procedure (col 1, lines 58-60)

Regarding claim 9, Grant discloses the vapor pressure in the reactor is 1-100 Torr (fig. 1) overlaps the claimed range of 25-75 Torr

Regarding claim 10, Grant discloses that all species present during HF/methanol etching should be in the vapor phase at 60^0 C/the temperature inside the chamber at 60^0 (col 4, lines 62-63) overlaps the claimed range of 25-80 ^{0}C

5. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grant et al (US 5,439,553) in view of Bergman et al (US 6,126,734) and further in view of Cole et al (US 6,238,580)

Grant discloses a method for controlled etching oxide layer/silicon oxide layer via gas phase reactions. This method comprises the steps of:

supplying gas phase HF and methanol, the methanol/alcohol is responsible for initiating the etching process (col 7, lines 1-27), which reads on supplying bubbled alcohol vapor as a catalyst with anhydrous HF

selecting temperature which prevent condensation of the reactant (col 3, lines 49-51)

etching/removing oxide/silicon oxide in HF and methanol maintained in gas phase in a cluster tool apparatus, etching was achieved at a preset temperature and pressure such that all species are substantially maintained in gas phase (see abstract ; col 7,

lines 1-13), which reads on performing a vapor etching by controlling a temperature and a pressure to be within the vapor region of a phase equilibrium diagram of water to remove oxide

Grant also discloses that HF_2 are likely responsible for oxide etching in the case of HF/methanol etching (col 7, lines 48-50), which reads on the vapor etching via a slow gas-solid reaction is controlled by formation of HF_2 resulted from ionization reaction between anhydrous HF and alcoholic vapor. Grant further discloses that all species present during HF/methanol etching should be in the vapor phase at 95^0 C and higher (col 4, lines 62-67) and the preset temperature of the substrate is from 20-95^0 C, etching is performed at a pressure such that all species present are substantially maintained in the gas phase and condensation of species present on the etched surface is controlled (col 4, lines 57-67; col 9, lines 11-12), which reads on the temperature of the etching chamber is maintained to be higher that that of the substrate so as to discharge the gas without condensing the water and to control physical absorption amount of reactant molecule absorbed on the sacrificial layer.

Unlike the instant claimed invention as per claim 1, Grant does not specifically disclose maintaining a temperature of the supplying device and a moving path of the anhydrous HF and the alcohol to be higher than a boiling point of the alcohol although Grant discloses selecting temperature which prevent condensation of the reactant

However, Bergman discloses a semiconductor processing method using vapor mixture, the method comprises the step of heating the vapor generator and vapor branch to a temperature of 20-100^0 C (col 12, lines 7-10). Bergman's teaching reads

on maintaining a temperature of the supplying device and a moving path of the anhydrous HF and the alcohol to be higher than a boiling point of the alcohol because a temperature at 100^0 C is defined as the temperature higher than a boiling point of the acohol in page 7 of the specification.

Since Grant discloses selecting temperature which prevent condensation of the reactant in the chamber, one skilled in the art would have found it obvious to modify Grant method by heating the HF source and the tube to a temperature of 100^0 C as taught by Bergman because according to Bergman desired temperature for heating the vapor generator more preferably at 20-100^0 C (col 11, lines 7-9)

Grant and Bergman do not specifically disclose removing silicon oxide of a sacrificial layer on the microstructure in a MEMS (micro electron mechanical system) device.

However, Cole discloses a method of vapor etching to release a microelectromechanical system (MEMS) having laminated layer structure comprises the step of removing silicon oxide of a sacrificial layer using vapor HF (col 2, lines 66-67)

Since both Grant and Cole are concerned with method of removing silicon oxide using HF, one skilled in the art would have found it obvious to employ Grant's teaching of removing the oxide with a vapor etching employing anhydrous HF and vapor alcohol in Cole's step of removing a sacrificial silicon oxide layer in a MEMS device since Cole teaches that the removal of the sacrificial /oxide layer with vapor phase etching is desirable in that it replaces the whole sequence of etching, rinsing step and elaborate drying procedure (col 1, lines 58-60)

Regarding claim 2, Grant discloses that the vapor HF partial pressure is 5-20 Torr (fig. 6) overlaps the claimed range of 2-50 Torr.

Regarding claim 3, Grant discloses that the preset temperature of the substrate is from 20-95^0 C (col 9, lines 12-13) overlaps the claimed ranges of 25-75^0 C. Grant also discloses that all species present during HF/methanol etching should be in the vapor phase at 60^0 C/the temperature inside the chamber at 60^0 (col 4, lines 63-64)

Regarding claim 5, Grant discloses etching oxide such as BPSG (col 5, lines 7-8)

The limitations of claims 6, 7 have been discussed above.

Unlike the instant claimed invention as per claim 4, Grant and Bergman do not disclose performing a wet etching step preceding the step of vapor etching the oxide layer.

Cole also discloses performing a wet etching step preceding the step of vapor etching the oxide layer (col 2, lines 64-67)

Hence, one skilled in the art would have found it obvious to modify Grant and Bergman by adding the step of performing a wet etching step preceding the step of vapor etching the oxide layer as per Cole because Cole teaches that the combines wet and vapor etching process offer advantage because the wet etch quickly remove the large filed option of the sacrificial/oxide and the vapor HF reduce water content and quickly remove the MEMS without substantial stiction (col 4, lines 3-11)

Response to Arguments

6. Applicant's arguments with respect to claims 1-10 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.

LV
May 29, 2003